PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:
GERALD LEVY
PITNEY, HARDIN, KIPP & SZUCH LLP
685 THIRD AVENUE
NEW YORK, NY 10017-4024

PCT

NOTIFICATION OF TRANSMITTAL OF INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Rule 71.1)

Date of Mailing *(day/month/year)*	10 NOV 2004
Applicant's or agent's file reference 37906-107553	**IMPORTANT NOTIFICATION**

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US03/33353	21 October 2003 (21.10.2003)	21 October 2002 (21.10.2002)

Applicant

LAIRD TECHNOLOGIES, INC

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.

2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.

3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. **REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices)(Article 39(1))(see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

Name and mailing address of the IPEA/US	Authorized officer
Mail Stop PCT, Attn: IPEA/US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (703) 305-3230	Ling X. Xu DEBORAH A. THOMAS PARALEGAL SPECIALIST Telephone No. 571-272-1700 ~~GROUP 1300~~ Dat

PATENT COOPERATION TREATY

PCT

REC'D 12 NOV 2004
WIPO PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
37906-107553		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US03/33353	21 October 2003 (21.10.2003)	21 October 2002 (21.10.2002)

International Patent Classification (IPC) or national classification and IPC

IPC(7): B05D 5/12; B32B 9/00 and US Cl.: 427/128, 126.2; 174/135R; 428/323, 325, 334, 421, 423.1, 446, 457, 469, 492, 474.2, 411.1, 500, 688

Applicant

LAIRD TECHNOLOGIES, INC

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 3 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 6 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☐ Non-establishment of report with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - VI ☐ Certain documents cited
   - VII ☐ Certain defects in the international application
   - VIII ☐ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
20 May 2004 (20.05.2004)	04 November 2004 (04.11.2004)

Name and mailing address of the IPEA/US
Mail Stop PCT, Attn: IPEA/US
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
Facsimile No. (703) 305-3230

Authorized officer
Ling X. Xu
Telephone No. 571-272-1700

DEBORAH A. THOMAS
PARALEGAL SPECIALIST
~~GROUP 1800~~ Dat

Form PCT/IPEA/409 (cover sheet)(July 1998)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/US03/33353

I. Basis of the report

1. With regard to the elements of the international application:*

☐ the international application as originally filed.

☒ the description:
pages 1-20 as originally filed
pages NONE, filed with the demand
pages NONE, filed with the letter of _____.

☒ the claims:
pages NONE, as originally filed
pages NONE, as amended (together with any statement) under Article 19
pages NONE, filed with the demand
pages 21-26, filed with the letter of 21 September 2004 (21.09.2004)

☒ the drawings:
pages 1/10-10/10, as originally filed
pages NONE, filed with the demand
pages NONE, filed with the letter of _____.

☐ the sequence listing part of the description:
pages NONE, as originally filed
pages NONE, filed with the demand
pages NONE, filed with the letter of _____.

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.
These elements were available or furnished to this Authority in the following language _____ which is:

☐ the language of a translation furnished for the purposes of international search (under Rule23.1(b)).

☐ the language of publication of the international application (under Rule 48.3(b)).

☐ the language of the translation furnished for the purposes of international preliminary examination(under Rules 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

☐ contained in the international application in printed form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☐ The amendments have resulted in the cancellation of:

☐ the description, pages NONE

☐ the claims, Nos. NONE

☐ the drawings, sheets/~~fig~~ NONE

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).**

** Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).*
*** Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.*

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.
PCT/US03/33353

V. Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. STATEMENT

Novelty (N)	Claims 1-6, 9-27 and 30-31	YES
	Claims none	NO
Inventive Step (IS)	Claims 1-6, 9-27 and 30-31	YES
	Claims none	NO
Industrial Applicability (IA)	Claims 1-6, 9-27 and 30-31	YES
	Claims NONE	NO

2. CITATIONS AND EXPLANATIONS

Claims 1-6, 9-27 and 30-31 meet the criteria set out in PCT Article 33(2)-(3), because the prior art does not teach or fairly suggest the claimed invention.

Claims 1-6, 9-27 and 30-31 meet the criteria set out in PCT Article 33(4), and thus have industrial applicability because the subject matter claimed can be made or used in the electronic device industry.

NEW CITATIONS

WHAT IS CLAIMED IS:

1. A thermally conductive composite material for reducing electromagnetic emissions generated by an electronic device, said thermally conductive composite material comprising in combination:

a thermally conductive material in particulate form; and

an electromagnetic-energy-absorptive material in particulate form,

said thermally conductive material and said electromagnetic-energy-absorptive material being suspended within a polymeric base material, said polymeric base material being substantially transparent to electromagnetic energy,

wherein said thermally conductive material facilitates transfer of thermal energy from said electronic device and said electromagnetic-energy-absorptive material reduces electromagnetic emissions generated by the device.

2. A thermally conductive composite material as claimed in claim 1 wherein at least one of said thermally conductive material and said electromagnetic-energy-absorptive material comprises particles in the form of granules having a shape selected from the group consisting of spheroids, ellipsoids and irregular spheroids.

3. A thermally conductive composite material as claimed in claim 1 wherein at least one of said thermally conductive material and said electromagnetic-energy-absorptive material comprises particles having a form selected from the group consisting of strands, flakes, powder and combinations thereof.

4. A thermally conductive composite material as claimed in claim 1 wherein said

AMENDED SHEET

thermally conductive material is selected from the group consisting of aluminum nitride, boron nitride, iron, metallic oxides and combinations thereof.

5. A thermally conductive composite material as claimed in claim 1 wherein said thermally conductive material is a ceramic material.

6. A thermally conductive composite material as claimed in claim 1 wherein said electromagnetic-energy-absorptive material is selected from the group consisting of electrically conductive material; metallic silver; carbonyl iron powder; an alloy of iron, silicon and aluminum; ferrites; iron silicide; magnetic alloys; magnetic flakes; magnetic materials; and combinations thereof.

7. Canceled.

8. Canceled.

9. A thermally conducting composite material as claimed in claim 1 wherein said polymeric base material has a relative dielectric constant of less than approximately 4 and a loss tangent of less than approximately 0.1.

10. A thermally conductive composite material as claimed in claim 1 wherein said polymeric base material is selected from the group consisting of elastomers, natural rubbers, synthetic rubbers, PDP, EPDM rubber, and combinations thereof.

11. A thermally conductive composite material as claimed in claim 1 wherein said

AMENDED SHEET

polymeric base material comprises a polymer.

12. A thermally conductive composite material as claimed in claim 1 wherein said polymeric base material is selected from the group consisting of silicone, fluorosilicone, isoprene, nitrile, chlorosulfonated polyethylene, neoprene, fluoroelastomer, urethane, thermoplastics, thermoplastic elastomer (TPE), polyamide TPE, thermoplastic polyurethane (TPU), and combinations thereof.

13. A thermally conductive composite material as claimed in claim 1 wherein said polymeric base material is a solid material selected from the group consisting of thermoplastic and thermosetting materials.

14. A thermally conductive composite material as claimed in claim 1 wherein said polymeric base material is a liquid.

15. A thermally conductive composite material as claimed in claim 14 wherein said liquid is selected from the group consisting of silicones, epoxies, polyester resins, and combinations thereof.

16. A thermally conductive composite material as claimed in claim 1 wherein said polymeric base material comprises a phase-change material existing in a solid phase at ambient room temperature and transitioning to a liquid phase at equipment-operating temperatures.

17. A thermally conductive composite material as claimed in claim 1 wherein said

AMENDED SHEET

polymeric base material comprises a mixture of a paraffin wax and an ethylene-vinyl acetate copolymer.

18. A thermally conductive composite material as claimed in claim 1 wherein said polymeric base material comprises a synthetic wax having a melting point of approximately 100°C and a molecular weight of approximately 1000.

19. A thermally conductive composite material as claimed in claim 1 wherein said electromagnetic-energy-absorptive material has a relative magnetic permeability greater than about 3.0 at approximately 1.0 GHz and greater than about 1.5 at 10 GHz.

20. A thermally conductive composite material as claimed in claim 1 wherein said composite material is in the form of a sheet having a thickness greater than approximately 0.01 inches.

21. A thermally conductive composite material as claimed in claim 1 wherein said composite material is in the form of a sheet having a thickness less than approximately 0.18 inches.

22. A thermally conductive composite material as claimed in claim 1 wherein said composite material is in the form of a sheet, and further comprises an adhesive on at least one side of said sheet.

23. A thermally conductive composite material as claimed in claim 22 wherein said adhesive is a thermoconductive adhesive.

24. A thermally conductive composite material as claimed in claim 22 wherein said adhesive is a pressure-sensitive, thermally conductive adhesive.

25. A thermally conductive composite material as claimed in claim 22 wherein said adhesive is based on compounds selected from the group consisting of acrylics, silicones, rubbers and combinations thereof.

26. A thermally conductive composite material as claimed in claim 22 wherein said adhesive further comprises a ceramic powder.

27. A method of reducing electromagnetic emissions produced by a device comprising the steps:

(a) providing a thermally conductive material in particulate form;

(b) providing an electromagnetic-energy-absorptive material in particulate form;

(c) combining the thermally conductive material with the electromagnetic-energy-absorptive material;

(d) suspending the combined thermally conductive material and electromagnetic-energy-absorptive material in a polymeric base material; and

(e) placing the combined thermally conductive material and electromagnetic-energy-absorptive material suspended in a polymeric base material between said device and a proximate structure.

28. Canceled.

PETALUS

29. Canceled.

30. The method of claim 27 wherein the proximate structure comprises a heat sink.

31. The method of claim 27 wherein said device comprises an integrated circuit.

AMENDED SHEET

WHAT IS CLAIMED IS:

1. A thermally conductive composite material for reducing electromagnetic emissions generated by an electronic device, said thermally conductive composite material comprising in combination:

a thermally conductive material; and

an electromagnetic-energy-absorptive material,

wherein said thermally conductive material facilitates transfer of thermal energy from said electronic device and said electromagnetic-energy-absorptive material reduces electromagnetic emissions generated by the device.

2. A thermally conductive composite material as claimed in claim 1 wherein at least one of said thermally conductive material and said electromagnetic-energy-absorptive material comprises particles in the form of granules having a shape selected from the group consisting of spheroids, ellipsoids and irregular spheroids.

3. A thermally conductive composite material as claimed in claim 1 wherein at least one of said thermally conductive material and said electromagnetic-energy-absorptive material comprises particles having a form selected from the group consisting of strands, flakes, powder and combinations thereof.

4. A thermally conductive composite material as claimed in claim 1 wherein said thermally conductive material is selected from the group consisting of aluminum nitride, boron nitride, iron, metallic oxides and combinations thereof.

5. A thermally conductive composite material as claimed in claim 1 wherein said thermally conductive material is a ceramic material.

6. A thermally conductive composite material as claimed in claim 1 wherein said electromagnetic-energy-absorptive material is selected from the group consisting of electrically conductive material; metallic silver; carbonyl iron powder; an alloy of iron, silicon and aluminum; ferrites; iron silicide; magnetic alloys; magnetic flakes; magnetic materials; and combinations thereof.

7. A thermally conductive composite material as claimed in claim 1 wherein said thermally conductive material and said electromagnetic-energy-absorptive material are suspended within a matrix material.

8. A thermally conductive composite material as claimed in claim 7 wherein said matrix material is substantially transparent to electromagnetic energy.

9. A thermally conducting composite material as claimed in claim 8 wherein said matrix material has a relative dielectric constant of less than approximately 4 and a loss tangent of less than approximately 0.1.

10. A thermally conductive composite material as claimed in claim 7 wherein said matrix material is selected from the group consisting of elastomers, natural rubbers,

synthetic rubbers, PDP, EPDM rubber, and combinations thereof.

11. A thermally conductive composite material as claimed in claim 7 wherein said matrix material comprises a polymer.

12. A thermally conductive composite material as claimed in claim 7 wherein said matrix material is selected from the group consisting of silicone, fluorosilicone, isoprene, nitrile, chlorosulfonated polyethylene, neoprene, fluoroelastomer, urethane, thermoplastics, thermoplastic elastomer (TPE), polyamide TPE, thermoplastic polyurethane (TPU), and combinations thereof.

13. A thermally conductive composite material as claimed in claim 7 wherein said matrix material is a solid material selected from the group consisting of thermoplastic and thermosetting materials.

14. A thermally conductive composite material as claimed in claim 7 wherein said matrix material is a liquid.

15. A thermally conductive composite material as claimed in claim 14 wherein said liquid is selected from the group consisting of silicones, epoxies, polyester resins, and combinations thereof.

16. A thermally conductive composite material as claimed in claim 7 wherein said

matrix material comprises a phase-change material existing in a solid phase at ambient room temperature and transitioning to a liquid phase at equipment-operating temperatures.

17. A thermally conductive composite material as claimed in claim 7 wherein said matrix material comprises a mixture of a paraffin wax and an ethylene-vinyl acetate copolymer.

18. A thermally conductive composite material as claimed in claim 7 wherein said matrix material comprises a synthetic wax having a melting point of approximately 100°C and a molecular weight of approximately 1000.

19. A thermally conductive composite material as claimed in claim 1 wherein said electromagnetic-energy-absorptive material has a relative magnetic permeability greater than about 3.0 at approximately 1.0 GHz and greater than about 1.5 at 10 GHz.

20. A thermally conductive composite material as claimed in claim 1 wherein said composite material is in the form of a sheet having a thickness greater than approximately 0.01 inches.

21. A thermally conductive composite material as claimed in claim 1 wherein said composite material is in the form of a sheet having a thickness less than approximately 0.18 inches.

22. A thermally conductive composite material as claimed in claim 1 wherein said composite material is in the form of a sheet, and further comprises an adhesive on at least one side of said sheet.

23. A thermally conductive composite material as claimed in claim 22 wherein said adhesive is a thermoconductive adhesive.

24. A thermally conductive composite material as claimed in claim 22 wherein said adhesive is a pressure-sensitive, thermally conductive adhesive.

25. A thermally conductive composite material as claimed in claim 22 wherein said adhesive is based on compounds selected from the group consisting of acrylics, silicones, rubbers and combinations thereof.

26. A thermally conductive composite material as claimed in claim 22 wherein said adhesive further comprises a ceramic powder.

27. A method of reducing electromagnetic emissions produced by a device comprising the steps:

(a) providing a thermally conductive material;

(b) providing an electromagnetic-energy-absorptive material; and

(c) combining the thermally conductive material with the electromagnetic-

energy-absorptive material.

28. A method as claimed in claim 27 further comprising the step of suspending the combined thermally conductive material and electromagnetic-energy-absorptive-material in a matrix material.

29. The method of claim 27 further comprising the step of placing the combined thermally conductive material and electromagnetic-energy-absorptive material between said device and a proximate structure.

30. The method of claim 29 wherein the proximate structure comprises a heat sink.

31. The method of claim 29 wherein said device comprises an integrated circuit.